Water Quality Technical Report

For the C-470 Corridor
Revised Environmental Assessment

July 2015

Submitted To:
CDOT Region 1
2000 S. Holly Street
Denver, CO 80222

COLORADO Department of Transportation

Submitted By:
Wilson & Company
1675 Broadway, Suite 200
Denver, CO 80202

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1.0 INTRODUCTION

The Colorado Department of Transportation (CDOT) and the Federal Highway Administration (FHWA) have identified a need for improvements to the C-470 corridor from Kipling Parkway to Interstate 25 (I-25).

1.1 Location

CDOT right-of-way within this portion of the C-470 corridor, which will be referenced as the "Study Area," is located in the South Denver Metropolitan area and crosses through portions of Douglas, Arapahoe, and Jefferson Counties and the Cities of Littleton and Lone Tree, as shown in **Figure 1**.

Figure 1. C-470 Corridor and Surrounding Vicinity

1.2 Purpose and Need

The purpose of proposed C-470 improvements is to address congestion and delay and improve travel time reliability for C-470 users. This Water Quality Technical Report is part of the 2015 Revised Environmental Assessment and identifies ultimate project improvements and changes to the Proposed Action described in the approved 2006 C-470 EA. This report also describes existing (No-Action) conditions and proposed mitigation measures to address potential environmental impacts in receiving waters due to stormwater runoff from ultimate (Proposed Action) improvements.

During an interim phase of the Proposed Action, improvements will be completed through a portion of the Study Area, approximately from Wadsworth Boulevard to I-25. Water quality improvements for the interim phase will be designed to be consistent with the Proposed Action ultimate improvements and mitigation measures.

1.3 Alternatives

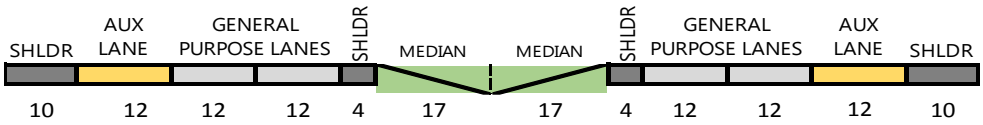
Two alternatives are presented and evaluated in the 2015 Revised Environment Assessment for the project. These alternatives include a No-Action Alternative and the Proposed Action. Aspects of these alternatives that have potential environmental impacts to water quality in receiving waters are described in this report.

C-470 No-Action Alternative

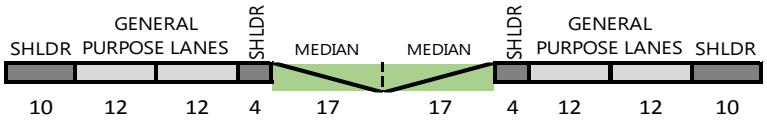
The No-Action Alternative involves taking no action to improve the existing C-470 roadway or its drainageway crossing structures between Kipling Parkway and I-25 other than performing basic maintenance and/or safety improvements to maintain roadway operation.

Within the Study Area, the existing C-470 roadway consists of two general-purpose lanes in each direction. An auxiliary lane in each direction exists between the Quebec Street interchange and the I-25 interchange, serving as continuous acceleration and deceleration lanes. The existing roadway (No-Action Alternative) consists of 12-foot travel lanes, including auxiliary lanes, with inside and outside shoulders, plus a 34-foot un-paved median, as shown in **Figure 2**. Paved shoulder widths vary between four and ten feet.

Figure 2. Typical Sections for No-Action Alternative



QUEBEC ST. TO I-25 – TWO LANES PLUS AUX LANE EACH DIRECTION
TOTAL WIDTH 134 FEET, 100 FEET IMPERVIOUS



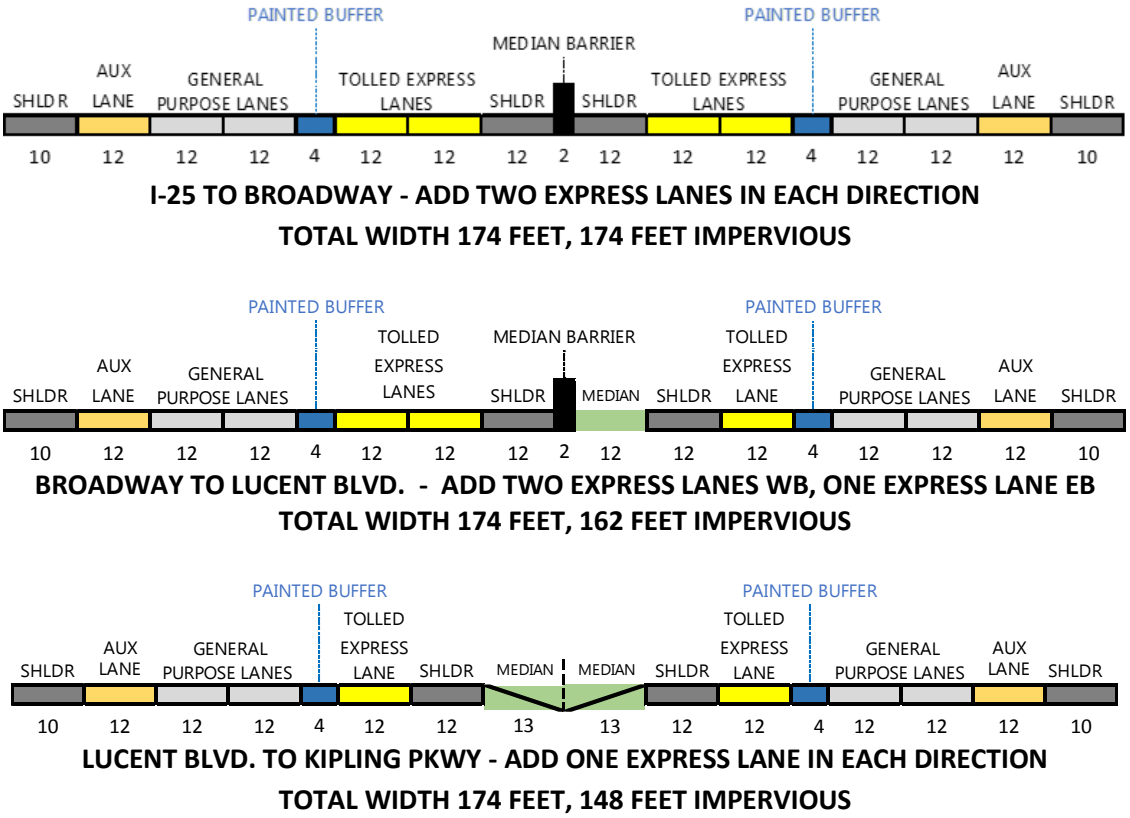
KIPLING PKWY TO QUEBEC ST - TWO LANES EACH DIRECTION
TOTAL WIDTH 110 FEET, 76 FEET IMPERVIOUS

Less than 10 percent of the existing roadway pavement runoff enters water quality treatment facilities that meet current permit requirements. Limited water quality treatment occurs as runoff is conveyed along vegetated roadside ditches.

C-470 Proposed Action

The Proposed Action would add one managed tolled express lane in each direction between I-25 and Kipling Parkway, and a second managed express lane between I-25 and Lucent Boulevard, westbound and Broadway to I-25, eastbound. These new through lanes, plus new auxiliary lanes, where warranted, would supplement the existing (free) general-purpose lanes, which would be reconstructed. The proposed typical sections are shown in **Figure 3**. The project will also add new direct-connect ramps to serve some movements at the C-470/I-25 interchange.

Figure 3. Typical Sections for Proposed Action



1.4 Applicable Statutes and Regulations

Applicable statutes and regulations are noted below:

Federal Water Quality Laws and Regulations

- *The Clean Water Act:* The Clean Water Act (CWA) established the National Pollution Discharge Elimination System (NPDES) program. The U.S. Environmental Protection Agency (EPA) has delegated the authority to implement the regulations of the Clean Water Act and NPDES to the Colorado Department of Public Health and Environment (CDPHE) under Sections 402, 401 and 303(d), as well as the MS4 permit system (see below).
- *CWA Section 404 (permitting for dredge or fill in the nation's waterways, as administered by the U.S. Army Corps of Engineers):* This regulation will apply to any work in "waters of the United States" within the project area such as drainageways and jurisdictional wetlands.

State Regulations

In Colorado, CDPHE's Water Quality Control Division (WQCD) administers regulation sections 402, 401 and 303(d) of the Clean Water Act.

- *CWA Regulation Section 402 (National Pollution Discharge Elimination System, or NPDES, which is administered by Colorado under the Colorado Discharge Permit System, or CDPS)*.
- *Regulation Section 401 (certification by states that federally-permitted activities comply with state water quality standards):* In Colorado, this is administered by CDPHE. In most cases, a Section 401 certification will be obtained automatically when a Section 404 permit is issued for the project.
- *Regulation Section 303(d) (state designation of water bodies that do not meet water quality standards for their designated uses and to develop Total Maximum Daily Loads (TMDLs) to bring the water body up to the required water quality standard):* The State of Colorado is responsible for developing TMDLs for impaired waters.

Regulation 31: the Colorado Water Quality Control Commission (WQCC) establishes the basic standards and methodologies for surface waters throughout Colorado (CDPHE, 2013).

Regulation 38: sets the water quality standards for surface waters within the South Platte Basin (CDPHE, 2014a).

Regulation 61: establishes the regulations that apply to the discharges from any point source to waters of the State, and includes regulations for the General Permit for Stormwater Discharges from Construction Activities and Municipal Separate Storm Sewer System Discharge (MS4) Permits (CDPHE, 2015).

Regulation 85: Establishes requirements for nutrient controls, including more requirements for MS4 permittees (CDPHE, 2012c).

Permits Required:

- 404 Permit: from USACE for any impacts to wetlands or waters of the U.S.
- 401 Certification: from CDPHE (automatic for CDOT unless an Individual Permit is required)
- CDPS Permit from CDPHE for Stormwater Discharges from Construction Activities.
- SB40 Permit: for aquatic life impacts related to construction in and adjacent to Waters of the State.
- USACE permission: needed for C-470 improvements between Wadsworth Boulevard and Santa Fe Drive, a 3-mile stretch of C-470 where the highway is situated not on State-owned right-of-way but instead on an easement from USACE.

Municipal Separate Stormwater Sewer Systems (MS4) Permits

CDPHE most recently issued CDOT a Phase 1 MS4 permit on December 2006 that applies to state and interstate highways and their rights-of-ways within “urbanized areas,” as defined by the CDPHE. The CDOT MS4 permit area covers nearly all of the

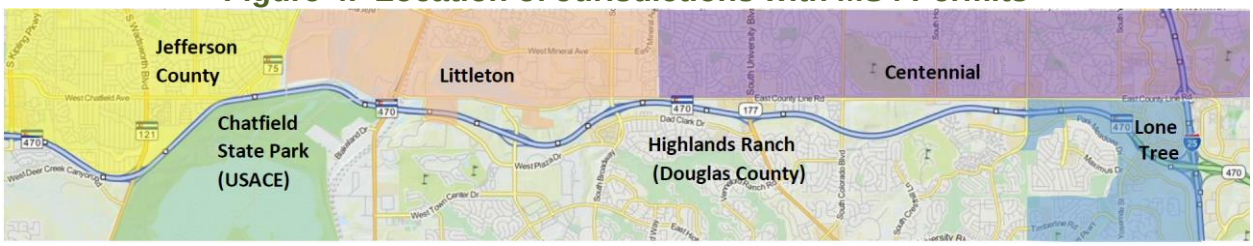
C-470 project area. That permit expired on January 31, 2012, but has remained in effect pending issuance of a new permit. In 2014, CDPHE modified CDOT's New Development & Redevelopment Program significantly, in response to a modification requested by CDOT on April 17, 2014. The request was approved with conditions issued on April 22, 2014 (CDPHE, 2014b) and May 22, 2014 (CDPHE, 2014c). The result is the CDOT NDRD Interim Guidance, dated September 18, 2014 (CDOT, 2014), herein after, referred to as the "2014 Interim NDRD Guidance". The 2014 NDRD was further modified by a CDPHE letter to CDOT dated January 8, 2015 (CDPHE, 2015b), herein after referred to as the "2014 Interim NDRD Program" or "2014 NDRD". To simplify contracting and administration of the regulations, the requirements of the 2014 Interim NDRD Program will be applied to the entire project area.

The 2014 Interim NDRD Program includes a change of terminology from "Best Management Practices (BMPs) to "Control Measures (CMs)" for Permanent Water Quality facilities. However, since the new MS4 permit has not been received and the terminology could change again at that time, this Technical Report will continue to refer to permanent water quality facilities and activities as "BMPs".

Other MS4 permits are held by counties, municipalities, districts, and other agencies that overlap or are located adjacent to or near the project area. These MS4 permit holders are listed below and their locations along the corridor are indicated in **Figure 4**.

- Jefferson County
- Douglas County
- City of Littleton
- Colorado Parks and Wildlife (Chatfield State Park)
- City of Lone Tree
- Highlands Ranch Metro District
- Arapahoe County
- City of Centennial

Figure 4. Location of Jurisdictions with MS4 Permits



Although it is anticipated that the requirements of the CDOT MS4 permit will be applied throughout the project area, requirements of the adjacent permits may apply if project facilities fall outside of the CDOT ROW.

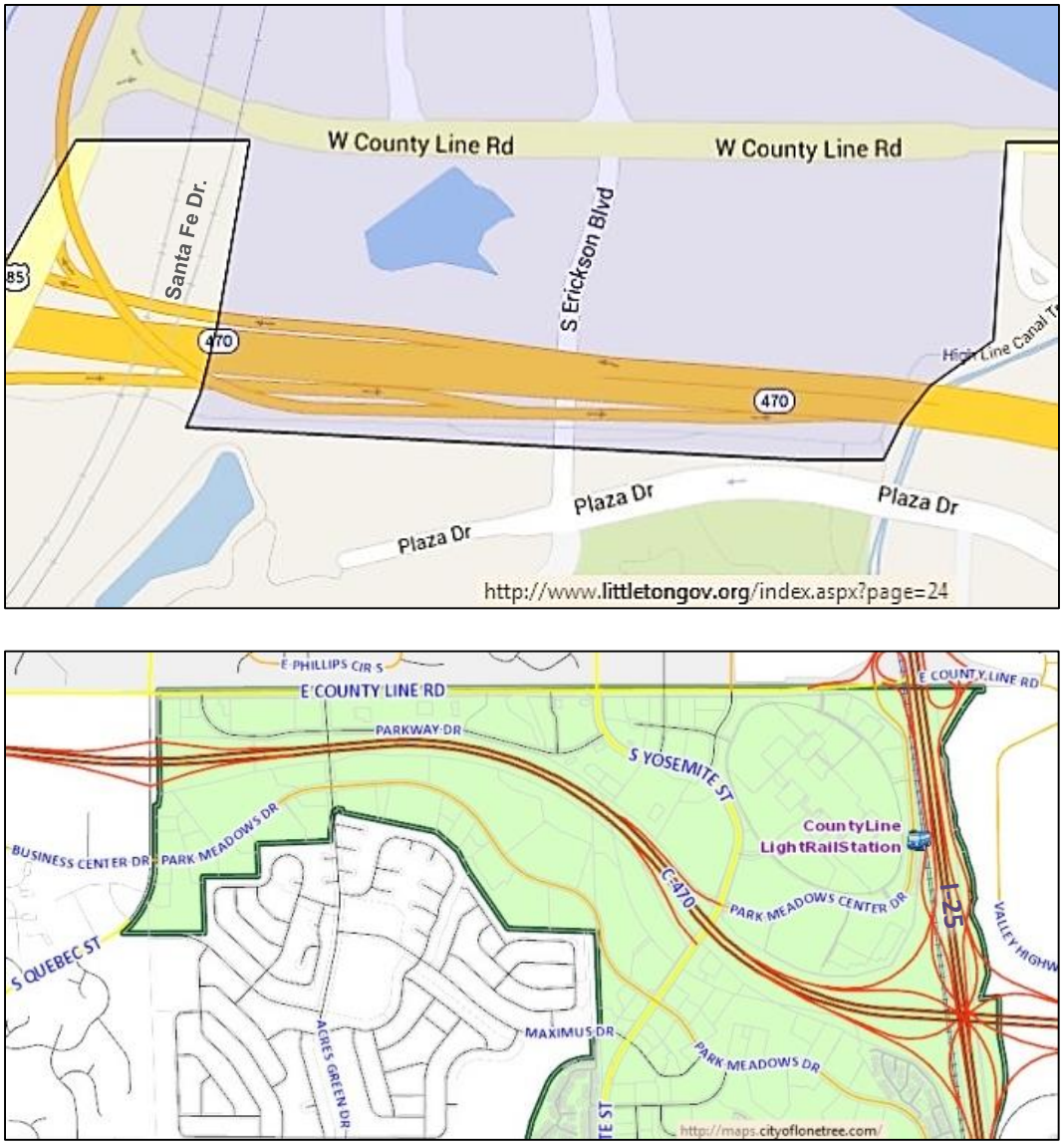
The two locations where C-470 is located within or adjacent to municipal boundaries are Littleton and Lone Tree. Per Section 43-2-135, C.R.S. and CDOT Policy 1050, maintenance requirements apply within municipal boundaries. **Figure 5** indicates the segments of C-470 that are located in Littleton and Lone Tree. C-470 is in Littleton for about 0.4 mile, from east of Santa Fe Drive to the Highline Canal, mileposts 17.112 to 17.588. C-470 is within Lone Tree for about two miles, from Quebec Street to I-25, mileposts 24.144 to 26.195. Within these areas, the statute requires municipalities to

maintain any permanent water quality BMPs built for the project that can be accessed from outside CDOT ROW.

1.5 Comparison with 2006 C-470 Environmental Assessment

The 2006 C-470 EA anticipated that runoff from 100% of impervious surfaces within the project area would be treated for water quality. However, the 2014 Interim NDRD Program modifies this goal.

Figure 5. C-470 Segments within Municipalities - Littleton and Lone Tree



Sources: City of Littleton, 2013; City of Lone Tree, 2013.

The 2014 Interim NDRD Program requires that runoff from impervious surface areas equal to or greater than 90% of the *increase* in impervious surface area be treated for water quality. The increase in impervious surface area is the difference between pre-project (No-Action) and post-project (Proposed Action) conditions over the entire

project. **Table 1** compares both the 2006 Preferred Alternative and the 2015 Proposed Action Alternative to the No-Action (existing condition) alternatives for the entire project. The increase in impervious area due to the Proposed Action is 119.8 acres. About 4.4 acres of the new impervious area will be treated by existing facilities at Santa Fe Drive. According to the 2014 Interim NDRD Program, runoff from 90% of this area, or 107.8 acres, must be treated. The Proposed Action would provide water quality treatment for runoff from an additional 185.1 impervious acres, or about 172% of the required area. By treating more than the minimum required area, CDOT is committing, not only to preserve, but to improve stormwater quality in the corridor.

Portions of the project area that discharge directly to waters listed as having a roadway related impairment, based on the CWA Section 303(d) list, must be accounted for separately. Therefore, because the South Platte River is listed for an arsenic impairment (**Table 2**), runoff from at least 90% of the project added impervious surface area that contributes directly to the S. Platte River must be treated by facilities within that drainage basin.

Table 1. Comparison of 2006 Preferred Action and 2015 Proposed Action to No-Action Alternatives

Scenario	Features	Impervious Surface Area[1]	Portion of Project Area Addressed with BMPs[2]
2006 Existing Condition	Four-lane highway built prior to current MS4 requirements.	135 acres	Less than 10 percent
2006 EA Preferred Alternative	Widen to eight-lane highway, with Colorado Blvd. T-ramps, median barriers and Santa Fe interchange improvements	322 acres = 187 acres more than the 2006 existing condition	100%, in accordance with MS4 permit (estimated 53 water quality ponds)
2015 Existing Condition (Future No-Action Alternative)	Same highway as 2006, plus Santa Fe Dr. interchange improvements completed in 2011 (flyover ramp)	204.9 acres	Less than 10 percent including 5.7 acres treated with BMPs in place at Santa Fe Dr.
2015 Revised EA Proposed Action	Widen to eight-lane highway plus auxiliary lanes, ramps and I-25 Interchange improvements	324.7 acres = 119.8 acres more than the 2015 existing condition	185.1 acres, including 65.3 acres of existing impervious area, or 172% of the 107.8 acres required by the 2014 NDRD

1. Differences between pre-project areas are due to the more detailed delineation of subbasin areas available for the 2015 report and differences in project extents such as the inclusion of the Santa Fe Dr. flyover, interchange ramps and the addition of interchange improvements at I-25.
2. Water quality treatment will be provided for at least 90% of new impervious areas within the S. Platte River drainage basin separately and for at least 90% of the new impervious areas outside of the S. Platte River drainage basin.

2.0 RECEIVING WATERS OF INTEREST

The entire Study Area is within the South Platte River basin. Runoff is discharged to six major drainageways and two constructed reservoirs as shown on **Figure 6**. Information describing the general characteristics of these water bodies and their regulatory status is contained in **Table 2.** None of the receiving waters is designated as "Outstanding Waters" (CDPHE, 2012a).

Table 2. Receiving Waters Summary

Figure I.D.	Water Body Name	Water Body Type	CDPHE, WQCD[1] Water Body I.D.	CWA[2] Section 303(d) Impairment	303(d) Priority	Watershed Size[3] (square miles)
1	Massey Draw	Stream	COSPUS07	-	-	1.34
2	Chatfield Reservoir[4]	Lake	COSPUS06b	-	-	3,018
3	South Platte River	Stream	COSPUS14	Arsenic	High	3,024.1
4	McLellan Reservoir	Lake	COSPUS22a	-	-	9.24
5	Dad Clark Gulch	Stream	COSPUS16c	Selenium	Low	7.61
6	Lee Gulch	Stream	COSPUS16c	Selenium	Low	0.12
7	Big Dry Creek	Stream	COSPUS16c	Selenium	Low	12.36
8	Willow Creek	Stream	COSPUS16c	Selenium	Low	4.91

1. Colorado Department of Public Health and Environment, Water Quality Control Division (CDPHE, 2013)
2. Clean Water Act (1987).
3. Watershed size of lake or portion of stream located upstream of C-470.
4. Chatfield Reservoir was removed from the 303(d) list for phosphorous impairment in 2009, when its TMAL went into effect, per WQCC Regulation 73 in 2009.

The approximate portions of the project area that contribute runoff to each of the receiving waters are shown in **Table 3**. Several receiving waters are listed as impaired in the State of Colorado Section 303(d) list. The segment of the South Platte River that crosses through the project area has a "high priority" impairment for arsenic. Dad Clark Gulch, Lee Gulch, Big Dry Creek, and Willow Creek each have "low-priority" impairment for selenium. Chatfield Reservoir is no longer listed as impaired for phosphorous since it is now governed by Regulation 73—Chatfield Reservoir Control Regulation (2009).

Figure 6. Receiving Waters of Interest

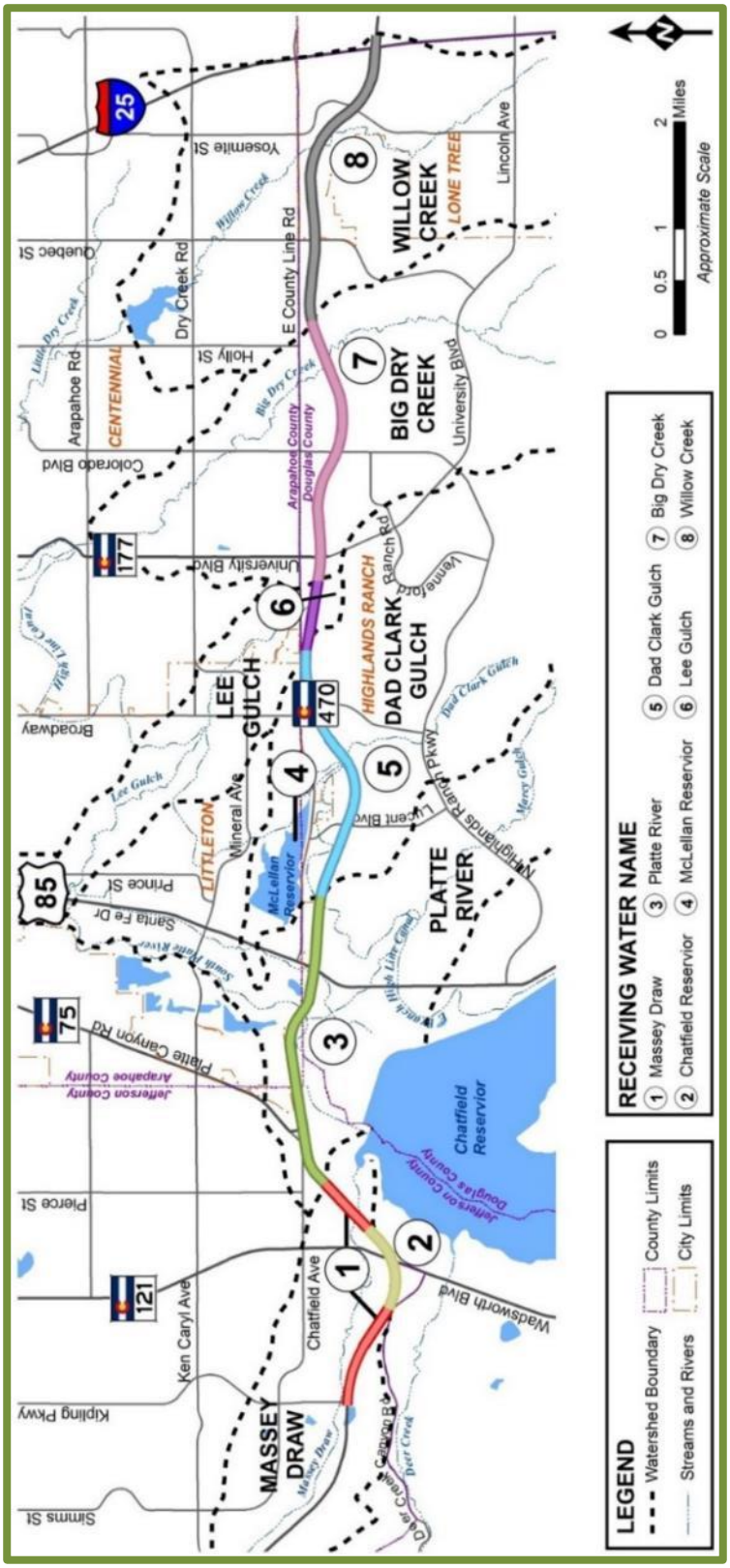


Table 3. Contributing Project Area Summary

Receiving Water	Approximate Limits of Contributing Project Area (Roadway Stations)	Approximate Contributing Project Area* (acres)
Massey Draw	690+00 to 724+00 and 757+00 to 819+00	57.4
Chatfield Reservoir	724+00 to 780+00	19.3
South Platte River	819+00 to 971+00	94.9
McLellan Reservoir and Dad Clark Gulch	971+00 to 1115+00	118.6
Lee Gulch	1115+00 to 1145+00	17.5
Big Dry Creek	1145+00 to 1273+00	68.7
Willow Creek	1273+00 to 1413+00	185.5
Totals	**690+00 to 1413+00**	**562.0**

*Area includes entire drainage basin, including pervious and impervious surfaces.

3.0 ISSUES

3.1 Existing Issues

C-470 was constructed in the 1980s, prior to development of the 2014 NDRD stormwater runoff water quality treatment requirements. As noted earlier, less than ten percent of the existing roadway pavement discharges to water quality treatment facilities that meet current requirements. Thus, water quality mitigation for the Proposed Action offers an opportunity to improve water quality for runoff from the existing freeway.

3.2 Potential Construction Phase Issues

During construction of the Proposed Action, roadside vegetation would be temporarily removed to accommodate grading and other construction activities. Soil would be exposed and more vulnerable to erosion and downstream sedimentation during rainfall and snowmelt events. In addition, materials and equipment common to the construction of highways could contaminate surface waters if not properly handled.

3.3 Potential Post-Construction Issues

The Proposed Action would result in the following potential post-construction issues that could negatively impact water quality if not properly managed and mitigated.

- The Proposed Action would increase impervious surfaces in the C-470 project right-of-way (ROW) and thus, would result in increased runoff volume and peak flow rates from the roadway. The Proposed Action increases in impervious areas and impervious areas to be treated with BMPs are summarized in **Table 4** by receiving water. The increased volumes and flow rates could erode soils along concentrated flow paths resulting in increased sediment and pollutants in the runoff if proper stabilization and permanent water quality BMPs are not implemented.

- The Proposed Action would add vehicle capacity to the roadway which is expected to result in increased traffic volumes. Existing annual average daily traffic ranges from 61,000 to 106,000 vehicles per day in 2013 and volumes are expected to increase by about 51% over the next two decades (CDOT, 2015a), or to 92,000-162,000 vehicles per day. This could result in additional pollutants being deposited on the roadway which may be mobilized and conveyed by runoff from the roadway (Smith and Granato, 2009). Any additional pollutants could flow to downstream receiving waters if proper permanent BMPs are not implemented.
- The Proposed Action would require grading of slope areas which could erode and result in additional sediment conveyed in runoff to receiving waters if the slope areas are not properly stabilized.
- The paved surface added by the Proposed Action would increase the application of deicing material in the corridor.

Table 4. Approximate Impervious Areas and Proposed Action Impervious Areas Treated with BMPs

Receiving Water	Impervious Area (acres)		Impervious Area Increase (acres)	Proposed Action Impervious Area Treated with BMPs	
	No-Action (Existing)	Proposed Action		(acres)	(Percent of Area Req'd)
Massey Draw	19.1	29.6	10.6	14.9	156%
Chatfield Reservoir	8.7	14.5	5.8	13.3	255%
South Platte River*	34.1	56.4	22.2	28.4	142%
McLellan Reservoir and Dad Clark Gulch	39.2	68.1	28.9	65.8	253%
Lee Gulch	7.2	12.5	5.3	6.1	128%
Big Dry Creek	24.8	46.4	21.7	15.4	79%
Willow Creek	71.8	97.2	25.3	41.2	180%
Totals	**204.9**	**324.7**	**119.8**	**185.1**	**172%**

* About 5.7 acres of existing impervious area is being treated by existing water quality ponds at Santa Fe Dr. and about 4.4 acres of new impervious area will also be treated at these facilities.

4.0 METHOD OF EVALUATION

4.1. Method

The CDOT NEPA Manual is the basis for determining whether or not water quality modeling is required for this project. Based on the Water Quality Modeling Decision Tree (Chapter 9, CDOT, 2013b), when a proposed action includes commitments to treat highway runoff, and the result is agreed upon as being beneficial, further modeling is not required (per Footnote #5 of the Decision Tree, CDOT 2013b). By adhering to the requirements of the 2014 Interim NDRD Program, the C-470 Proposed Action would result in less untreated runoff leaving the project site than in the No-Action Alternative (existing condition). Specifically, while the project increases impervious area by 119.8 acres (**Table 4**), the Proposed Action would treat 185.1 acres, including about 65.3 acres of existing impervious surface that is untreated in the existing condition. Thus, the Proposed Action would be beneficial for water quality.

4.2 Data Collection

The 303(d) and 305(b) lists as published in the "Integrated Water Quality Monitoring and Assessment Report, for the State of Colorado", 2012 Update were reviewed to obtain information about receiving waters impairments and designated use classifications. (CDPHE, 2012b). GIS maps available on the WQCD internet site were used to obtain stream segment identification numbers. Additionally, WQCD staff members were consulted for clarification or confirmation of stream segment and impairment information.

A computer-aided design program was used to calculate areas of the project contributing to individual receiving waters and impervious areas associated with the No-Action Alternative and the Proposed Action Alternative.

5.0 CONTEXT SUMMARY

5.1 Receiving Waters Classifications

Colorado Water Quality Control Commission Regulation 31 identifies how the state classifies water bodies and Regulation 38 identifies the classifications for the South Platte River Basin, which includes the C-470 project area. These classifications indicate the beneficial uses served by the various surface waters, in terms of their ability to support aquatic life, recreation, water supply and agriculture. Classifications for the receiving waters associated with the C-470 project area are shown in **Table 5.**

5.2 Receiving Waters Impairments

WQCC Regulation 93 identifies impaired waters in the State of Colorado. **Table 6** summarizes impairments of Project Area runoff receiving waters in the 303(d) list for 2012 (WQCC, 2012). The South Platte River is impaired for arsenic, whereas most other drainages are impaired for selenium. Arsenic and selenium are naturally occurring elements which are commonly found in bedrock in the Denver Metro Area. Arsenic has been reported in some summaries of highway runoff pollutants, but is rarely listed.

Minute amounts of arsenic may be found in liquid deicers, although CDOT limits the amount to less than 5 ppm. Arsenic has been found in very low levels in about 10% of the CDOT Wet Weather Monitoring program (CDOT, 2009-2012). Thus, it is included as one of seven pollutants that trigger additional 2014 NDRD requirements (as noted above, and in **Table 7**). Selenium is not directly associated with roadway use. However, soils in the project area may contain these elements and could be carried downstream if erosion is not kept in check. Regulation 73 limits phosphorous within the Chatfield Reservoir Basin through a Total Annual Maximum Load (TMAL). Although phosphorous is not directly related to highways, it can be found in some deicers (limited to 25 ppm in CDOT deicers) and attaches to sediment. In addition, increased erosion carries phosphorous into receiving streams.

Table 5. Receiving Waters Classification Summary

Receiving Water	Regulation #38 Classification / Beneficial Uses
Massey Draw	Aquatic Life Cold Water 2, Recreation E, Agriculture
Chatfield Reservoir	Aquatic Life Cold Water 1, Recreation E, Water Supply, Agriculture
Platte River	Aquatic Life Warm Water 1, Recreation E, Water Supply, Agriculture
McLellan Reservoir	Aquatic Life Cold Water 2, Recreation E, Water Supply, Agriculture
Dad Clark Gulch	Aquatic Life Warm 2, Recreation E, Agriculture
Lee Gulch	Aquatic Life Warm 2, Recreation E, Agriculture
Big Dry Creek	Aquatic Life Warm 2, Recreation E, Agriculture
Willow Creek	Aquatic Life Warm 2, Recreation E, Agriculture

Table 6. Receiving Waters Impairment Summary

Receiving Water	303 (d) Impairment	Approved TMDL/TMAL	303(d) Priority
Massey Draw	-	No	-
Chatfield Reservoir	-	Yes (Reg. 73)	-
Platte River	Arsenic	No	High
McLellan Reservoir	-	No	-
Dad Clark Gulch	Selenium	No	Low
Lee Gulch	Selenium	No	Low
Big Dry Creek	Selenium	No	Low
Willow Creek	Selenium	No	Low

6.0 IMPACT SUMMARY

6.1 Permanent Impacts

Water Quality in the Project Area receiving waters should benefit from the Proposed Action since more runoff from the C-470 corridor would be treated. With the No-Action Alternative (existing condition), only a small portion of the runoff from the roadway is currently treated. Permanent Water Quality BMPs constructed with the Proposed Action would treat runoff from an area of roadway surface equal to or greater than ninety percent (90%) of the increased roadway surface added due to the Proposed Action. Because the South Platte River segment receiving runoff from the project is listed for arsenic, one of the seven pollutants specified in the 2014 NDRD requirements (**Table 7**), ninety percent of the increased roadway surface area within this specific drainage basin will be treated by facilities within the basin.

6.2 Temporary Impacts

Temporary Impacts during construction are expected to include working within and adjacent to some of the identified receiving waters. For example, the Proposed Action would remove and replace the two parallel C-470 bridges over the South Platte River. Implementation of temporary BMPs will be required to prevent the transport of sediment from exposed, erodible soils into the receiving waters. The management and handling of materials and equipment during the construction phase would be conducted in accordance with pertinent sections of the CDOT Standard Specifications for Road and Bridge Construction and the CDOT Erosion Control and Stormwater Quality Guide, in compliance with a CDPS Construction Stormwater Permit.

6.3 Effect of the Proposed Action

Impacts of highway development on water quality may result from:

- Erosion and sedimentation related to cut and fill slopes,
- Increased concentrated runoff from impervious surfaces, and
- Increased highway-related pollutants related to winter maintenance.

Water running off roadways can contain pollutants. Pollutants of concern are identified in CDOT's New Development Redevelopment Program, Interim Guide (9/18/2014) and in CDPHE's letter to CDOT regarding CDPS Permit-New Development and Redevelopment Program Description Modification-Conditional Approval, CDPS Permit No.: COS 000005 (1/8/2015). **Table 7** lists CDOT highway runoff pollutants of concern and their normal sources.

Other common pollutants in CDOT highway runoff and their sources are: oil and grease from spills and leaks from motorized vehicles; phosphorus from the atmosphere, roadside fertilizer use and erosion; and nitrogen from the atmosphere, roadside fertilizer use and erosion. Highways do not generate phosphorus and nitrogen, but erosion and activities adjacent to highways lead to more of these nutrients in runoff. Winter maintenance in this area does not include sanding, which can also entrain nutrients.

Table 7. CDOT Highway Runoff Pollutants of Concern

Runoff Pollutant of Concern	Normal Pollutant Source
Arsenic	Soils, erosion, deicers (minor)
Chloride	De-icing salts
Chromium	Metal plating, engine parts, brake lining wear
Copper	Metal plating, bearing and bushing wear, moving engine parts wear, brake lining wear, fungicides, insecticides
Manganese	Moving engine parts
Zinc	Tire wear, motor oil, grease
Sediment	Pavement wear, vehicle fall-off, atmosphere, traction sand, erosion

The constituents listed in **Table 7** and the other common pollutants were found in wet-weather sampling along CDOT highways. This list is shorter than earlier summaries of constituents because the wet-weather monitoring demonstrated that several constituents considered to be common in highway runoff (CH2MHill, 2009) are not present in detectible amounts (CDOT, 2009-2012). For example, cadmium, chromium, nickel and selenium were not present or were below detection limits. In addition, all pH measurements were within the standard range of 6.5 to 9.0.

Annual Average Daily Traffic (AADT) for C-470 within the project area varies significantly between various segments. AADT in the project area ranged from 61,000 to 106,000 vehicles per day in 2013, and is projected to range from 93,000 to 161,000 by 2035 (Cambridge Systematics, 2014). Some highway-related pollutants (specifically metals and nutrients) may increase with large increases in traffic counts (Smith and Granato, 2009). Thus, increasing water quality treatment in the project area is important for both the No-Action and the Proposed Action.

Any Proposed Action must follow three steps to protect resources: (1) avoid impacts; (2) minimize impacts, and (3) mitigate for impacts. These are in sequential order, with avoidance having the highest priority.

Proposed Action impacts to the receiving waters would be minimized through implementation of temporary BMPs during construction and permanent BMPs post-construction including water quality conscious maintenance practices. Proposed BMPs are described in the following section.

7.0 MITIGATION STRATEGIES

The following are preliminary strategies for mitigation of impacts and are subject to change. Final mitigation measures will be determined in the design-build process.

7.1 Efforts to Avoid Impacts

Every reasonable effort will be made to avoid impacts to waterways and wetlands. One way this will be achieved is by the installation of retaining walls where roadway widening would normally require the extension of cross-culverts and disturbance of the adjacent drainageways. By placing retaining walls between the widened roadway and the culvert entrance and exits at some crossings, there will be no encroachment into the adjacent drainageways or their floodplains, avoiding potential impacts. However, given the increased impervious area that is required to achieve additional traffic capacity, total avoidance of impacts is not practical for the Proposed Action. In those areas, minimizing and/or mitigation will be implemented.

7.2 Efforts to Minimize Impacts

During the concept design phase of the project, engineers have worked to minimize project impacts. Examples include:

- Proposed narrowing of shoulders and buffer zones for short distances to accommodate the addition of ingress/egress lanes without widening the pavement area;
- Eliminating concrete barriers that were proposed in the 2006 EA between the roadway express and general purpose lanes, thus reducing concentrated runoff; and
- Reducing peak flow rates to pre-project stormwater runoff rates (using methods described in mitigation).

7.3 Mitigation of Impacts during Construction

A Stormwater Management Plan (SWMP) detailing how and where temporary BMPs will be used before, during and after construction will be developed for the Proposed Action. This document will evolve as the construction progresses to meet the changing needs of the project. Work on the project shall conform to the requirements of the CDOT Standard Specifications for Road and Bridge Construction and the CDOT Erosion Control and Stormwater Quality Guide. A Stormwater Construction Permit issued by CDPHE will be required for the project. Work on the project will be monitored by CDOT through its “Construction Sites Program”.

Numerous temporary BMPs will be required during the construction phase of the project. Temporary BMPs are described in the CDOT Erosion Control and Stormwater Quality Guide. The primary objective of the SWMP is to control pollutants at the source and to minimize the potential for degradation of water quality in the waters that receive construction area discharges. The SWMP should include, but not be limited to, the following general measures:

- Erosion Control Measures including minimizing soil disturbances and adequately stabilizing disturbed areas as soon as possible to prevent erosion;
- Sediment Control Measures including using adequate BMPs to collect and remove pollutants from runoff before it is discharged from areas under construction;

- Using adequate measures to prevent materials from being tracked by vehicles or carried by wind and deposited off-site; and
- Proper spill prevention, management and control measures.

7.4 Mitigation of Post-Construction Impacts

7.4.1 Permanent Water Quality BMP Design

Structural BMPs

Assuming that the Proposed Action is designed prior to implementation of the new MS4 permit, Permanent Water Quality BMPs will be constructed in adherence to the 2014 Interim NDRD Program. For the areas to be treated (as described above) the BMPs must meet one of the following design criteria (CDOT, 2014):

1. **WQCV Standard**: Provide treatment and/or infiltration of the water quality capture volume (WQCV) for all tributary areas to the BMP;

2. **Pollutant Removal Standard**: Provide for removal of Total Suspended Solids (TSS) equal to the mass of 80% of the expected annual TSS loading from stormwater runoff from 100% of all tributary areas to the BMP; or

3. **Infiltration Standard/Volume Reduction**: Infiltrate the water quality capture volume (WQCV) for all tributary areas through practices such as green infrastructure, for a quantity of water equal to 70% of what the calculated WQCV would be if all new impervious area for the project discharged without infiltration.

For the Front Range of Colorado, the WQCV is the first 0.5 inch of runoff from a storm event.

Permanent BMPs proposed for implementation with the Proposed Action will dominantly consist of, but not be limited to extended detention basins. Design will maximize ease of safe access, and will include input from Maintenance staff to accommodate available maintenance equipment. Depending on site conditions, local agency requirements, and space available, the following BMPs will be considered:

- Ecology Embankments/Media Filter Drains; and
- Pre-Manufactured Treatment Devices (Mechanical Devices).

These permanent BMPs and strategies are briefly described in the following sections. Vegetated swales may be included in the design, in series with other BMPs, but do not meet the above design criteria. More detailed information and design criteria for these BMPs can be found in the CDOT Erosion Control and Stormwater Quality Guide (2002a), the CDOT Drainage Design Manual (2002b), and Volume 3 of the Urban Drainage and Flood Control District Drainage Criteria Manual (2010).

Extended Detention Basins

Extended detention basins (EDBs) are sedimentation basins designed to detain stormwater for up to 72 hours in order to allow sediment time to settle out of the detained water. Given their detention function, EDBs also provide significant peak discharge rate mitigation in frequent runoff events which benefits downstream waterways. If EDBs are constructed in well-drained soils and maintained on a regular basis, they also facilitate reduction in runoff volume through infiltration. EDBs will be designed to provide 100% of the WQCV for their contributing watersheds on this project to satisfy the 2014 Interim NDRD Program requirements.

Ecology Embankments/Media Filters Drains

Ecology embankments/Media Filter Drains (MFDs) are designed for linear treatment of un-concentrated runoff (sheet flow) from paved surfaces. The MFDs are constructed into the side slopes of roadway embankments. They consist of a vegetated filter strip adjacent to the roadway shoulder and a downstream strip of filter media. After flowing through the filter and collecting in an underdrain system, the treated runoff is released to a downstream conveyance facility.

The filter media consist of crushed rock mixed with three amendments. The rock and amendments provide physical filtration of solids, while the amendments provide chemicals and the environment needed for pollutant removal by precipitation, ion-exchange, and sorption. Testing of MFDs has demonstrated water quality treatment for roadway runoff that includes greater than 80% removal of TSS in the water quality design event (Herrera, 2006).

CDOT has used this BMP in limited applications in recent years. MDFs would be used on an as-needed basis, especially where adjacent ROW is narrow and the slopes are conducive to use, or where planned EDBs are not feasible.

Pre-Manufactured Treatment Devices (Mechanical Devices)

Pre-manufactured treatment devices, or “mechanical devices” (MDs), include various filter and solids separation devices to enhance water quality. These devices are typically contained in an underground vault and can be placed virtually anywhere without impacting ROW requirements. However, this advantage is offset by high frequency of labor-intensive maintenance, enclosed-space safety concerns, and high equipment costs. MDs are only expected to be used on the project where there are no other reasonable options for treatment. Where used, MDs should be designed to provide treatment equivalent to either 100% storage of the WQCV or 80% TSS removal for the watershed contributing to the BMP.

Due to CDOT staffing and equipment constraints, it is important to design BMPs that will operate successfully with minimal required maintenance.

Vegetated Swales

Conveyance of runoff though stable, unpaved, vegetated swales and ditches can have the benefit of reducing the volume of runoff through infiltration, reduction of peak rates though infiltration and longer travel times, as well as some pollutant removal through filtration and sedimentation. Thus, where it is practical to do so, vegetated swales and roadside ditches will be used to collect runoff generated in the project area and convey it to downstream BMPs for additional treatment. Because they tend to be sparsely vegetated in the western U.S., such swales should primarily be used as conveyance facilities with some pretreatment benefits on this project. Swales may be used in conjunction with other BMPs to reach 80% TSS removal.

Non Structural BMPs/Operations

Non-structural BMPs will continue to be implemented in the maintenance of the roadway corridor. According to CDOT maintenance personnel, current practices by CDOT to mitigate water quality impacts from highway runoff include the following policies:

- Sand/salt mixtures are not used on C-470, because of the impact to air quality (from fugitive dust) and reduction of sediment (and entrained nutrients and metals) reaching local streams.

- CDOT is no longer pre-treating roads with liquid deicers. Applications begin with snowfall in order to minimize use of deicers.

- Liquid de-icing products used are magnesium chloride (“mag chloride”) and Caliber (a mixture of mag chloride, corn starches, alcohol, and tree sap). All of these deicers must meet strict limits on metals and phosphorous.

- For colder conditions, CDOT uses a product called Ice Slicer, an all-natural road salt that contains corrosion inhibitors.

- The C-470 corridor is not in the “core” sweeping area as defined for air quality purposes by the Denver Regional Council of Governments (DRCOG). Therefore, CDOT has up to four days to sweep 35 percent of the salt after snow events. Records from past years show that 100 percent of C-470 has been swept within four days.

- Pickup sweepers are used as part of on-going fleet upgrades; trash within the ROW is cleaned up prior to each sweeping.

- Fleet upgrades also include onboard computers to track and adjust the application rates of de-icing materials. Currently, 35 percent of the CDOT Region 1 fleet has this capability.

- The solid deicers are stockpiled at three covered storage facilities in the corridor to protect them from precipitation. This minimizes deicer loss and prevents saline from running off into receiving waters.

7.4.2 Permanent Water Quality Approach

The 2014 Interim NDRD Program encourages flexibility by allowing for coordination to create regional water quality BMPs where feasible, and for treating the equivalent area of new impervious surface where necessary.

Regional Treatment

Where practical, water quality treatment of runoff from the project area will be accomplished in regional water quality treatment facilities to reduce maintenance efforts and to better ensure long term effectiveness of the BMP. It is more efficient and cost-effective to monitor and maintain a smaller number of larger facilities that treat runoff from large areas than to maintain a larger number of smaller facilities treating runoff from an equivalent area.

To remain effective in the long term, BMPs will need to be maintained. Due to CDOT staffing and equipment availability constraints, it is important to design BMPs that will operate successfully with minimal maintenance.

Implementation of regional treatment will likely require the execution of maintenance agreements between CDOT and other agencies that have existing facilities or an interest in regional treatment facilities. CDOT will pursue such opportunities, with a focus on obtaining maintenance commitments from the local agencies in exchange for CDOT paying for much of the BMP construction or all retrofitting.

Equivalent Area Treatment

In some portions of the project, topography or limited space make treatment of new impervious area extremely difficult. The 2014 Interim NDRD Program allows for treatment of an equivalent area of existing impervious surfaces. This allows CDOT to focus on treating more area where it is easier and less expensive to treat. The result is that treated areas are anticipated to be 172% of the minimum required treated area (**Table 4**).

Other Mitigation Considerations

In several locations it will be very difficult and expensive to provide permanent BMPs within the existing ROW due to the presence of grading, utilities, and other constraints. Permanent BMPs in these areas may need to be located, at least partially, outside of the existing ROW and are likely to require the acquisition of additional ROW or the execution of maintenance agreements with owners of the adjacent parcels that the BMPs will be located on. In several locations the additional ROW needed for permanent BMPs is part of adjacent undeveloped land controlled by local governments.

Design of permanent BMPs for the portion of the project that is located adjacent to Chatfield Reservoir on land controlled by USACE will present special challenges. USACE has indicated that they do not support the construction of permanent BMPs for

the project outside of the existing C-470 easement area due to maintenance concerns (USACE, 2013). They also would like to see runoff from the project area collected and conveyed within the existing ROW to waterways that cross the roadway corridor instead of allowing discharge of runoff to adjacent USACE land. Where runoff is discharged to USACE land the rate of discharge must not exceed pre-project rates. Due to the limited area between the proposed roadway and the limits of the existing easement, it will be necessary to collect and convey project runoff to areas where adequate space is available.

8.0 AGENCIES CONTACTED

WQCD staff were contacted via phone calls and e-mail to provide clarification on stream segment identification and impairments. A meeting was held with USACE staff at Chatfield Reservoir to discuss the Proposed Action as it related to the Chatfield Reservoir property and USACE's preference for management of stormwater runoff from the portion of the roadway that passes through their property. Meetings were also held with local agencies including: City of Englewood (Englewood McLellan Reservoir District), Highlands Ranch Metropolitan District, City of Lone Tree, Arapahoe County, Douglas County and Jefferson County to discuss opportunities for cooperation, stormwater management issues and planned improvements. Drainage reports were collected from the various agencies with water quality jurisdiction along the corridor.

9.0 CONSULTATION WITHIN CDOT

Meetings were held with CDOT Region 1 water quality and maintenance staff members in the preparation of this document to discuss preferences, constraints and concerns related to the design and maintenance of permanent water quality treatment facilities for the project and long term maintenance practices associated with the roadway.

10.0 PERMITS NEEDED

Implementation of the Proposed Action would require water quality permits as follows:

- Any work within this project that goes below Ordinary High Water in Waters of the U.S. will require a 404 permit from the U.S. Army Corps of Engineers. This permit is discussed elsewhere within this EA.
- An individual 404 permit triggers the need for a 401 certification from Colorado Department of Public Health and Environment Water Quality Control Division. A nationwide 404 permit triggers an automatic and concurrent 401 certification.
- Proposed Action construction activities will disturb more than an acre of land and thus will need to be covered under a Stormwater Construction Permit under the Colorado Discharge Permit System.

The timing of the application for these permits will be determined as the project develops and the bid documents are prepared.

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